HAZARDOUS WASTE RESEARCH AND INFORMATION CENTER
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INDUSTRIAL WASTES IN THE CALUMET AREA, 1869–1970

An Historical Geography

by
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> The demand of a given manufactory that their wastes be disposed of without creating a nuisance would, in many instances be equal to the demand that they discontinue business inasmuch as the cost of disposal of these wastes in a satisfactory manner would be to prohibit the financial success of the industry.(51)

M.O. Leighton addressed the American Bureau of Public Health in 1904 and stated that research on industrial waste disposal lagged behind that for domestic sewage. This was due in part to the common understanding that "industrial wastes do not normally contain germs of disease."(52) He argued, however, that industrial wastes have an indirect bearing on public health. He cited evidence that biological wastes can burden natural filtration systems of rivers, and trade wastes from metal-working industries can prevent septic action of sewage disposal plants.(53) However, nuisances from trade wastes were not severe enough to impel public officials to action.

The legal system provided limited protection against stream pollution in the nineteenth century, although courts generally held polluters liable for damages caused by waste disposal in streams. Illinois' judicial branch protected the rights of riparian landowners to have both water quality and quantity undisturbed by upstream users.(54) Decisions during the early twentieth century continued this pattern, but apparently had little effect on the Calumet area. Water disposal continued unabated, and despite tainted supplies of process water, there is no record of suits by industries to halt pollution.

A complete account of waste disposal in the Calumet area is unavailable, but uncontrolled disposal of industrial wastes in waterways was the primary cause of pollution. One of the first complaints in the Chicago area came from the Army Engineers' commander who said that he felt it was futile to attempt to maintain the channel of the Grand Calumet. He wrote in 1893 that it "has been worse than useless as the channels excavated have filled up rapidly by slaughterhouse refuse and filth from manufacturing establishments and solid matter from the sewage poured into the dead stream."(55) Work on the section between the mouth of the Grand Calumet and Lake Calumet he described as "desultory," because:

> What goes into it stays there for lack of current to carry it off. Several towns and some great filth-producing manufacturing establishments have filled the dredge channels with filth as fast as excavated..."(56)

Aggradation in the main channel was also reported as early as 1891, but the cause cited was bank erosion, not waste disposal. As industries began to occupy the lots along the river, maintenance dredging became the major role of the Army Engineers. In 1895 redredging accounted for nearly twenty-five percent of the total expenditures on Calumet improvements in spite of the fact that the original plans were still far from complete.(57) The nature of the Army Engineers' duties lead the commander to protest that they were "simply the scavengers for the vicinity."(58)

George Pullman and his associates widely proclaimed their progressive

thinking about sewage removal. They felt it unwise "to permit the sewage to flow into Lake Calumet, as it would make a cesspool of that body of water."(58) Although Pullman's drinking water was supplied from Lake Michigan, the shops used water from Lake Calumet. To avoid fouling this source, Pullman built a showcase sewer system that linked both factory and town to a "sewage farm" near the Little Calumet River. In 1890, 1.8 million gallons of domestic and industrial wastes were pumped to the farm and spread over the fields. The percolation of the liquid wates through the soil was viewed as a means of filtration and fertilization.(60) However, by 1887 most sewage was directed into Lake Calumet "in order to save the crops."(61) Eventually, maintenance difficulties forced an abandonment of the sewage farm and by 1907 Pullman's sewage went untreated into the Little Calumet River.(62)

The effects of indiscriminate waste disposal did not go unrecognized. During a hearing on the feasibility of creating an inland port in Lake Calumet, the following remarks were made:

> Alderman Emerson: The water is so bad there [the mouth of the Calumet River] that they cannot bathe in the lake at the mouth of the river.
>
> Alderman Long: I think that was because of the discharge of the steel works.(63)

Indeed, there were dozens of outfalls from the factories that drained processing wastes as well as factory sanitation sewers. Little if any of the effluent was treated before discharge.

Bathers were not the only water users endangered during the early years of the twentieth century. So bad were the Calumet wastes, the Sanitary District began work on plans to divert the Calumet River from Lake Michigan. A report presented in 1909 charged that all sewers south of 87th street flowed into the Calumet River, and periodically this filth was washed into Lake Michigan, threatening Chicago's potable water.(64) Even the wastes from the Pullman plant were being pumped into the Little Calumet making it "quite objectionable."(65) Concerns over the wastes of the Calumet area led to discussions of a canal connecting the Calumet system with the Sanitary and Ship Canal. Such a plan would complete the redirection of streams in the Chicago region from the Great Lakes to the Mississippi River drainage basins. Until such a channel was completed however, industrial wastes continued to pour into Lake Michigan.

In addition to the liquid wastes, solids suspended in these liquid wastes began to pose health and navigational problems. Solids emitted to the river in solution or suspension settled on the river bed and had to be dredged to maintain the channel of the Calumet River. Contractors barged most of these wastes to nearby Lake Michigan. Authorities realized the potential danger these wastes posed to drinking water as early as 1911. Although at the time, Congress prohibited dumping dredge spoil within eight miles of water intakes, violations continued.(66)

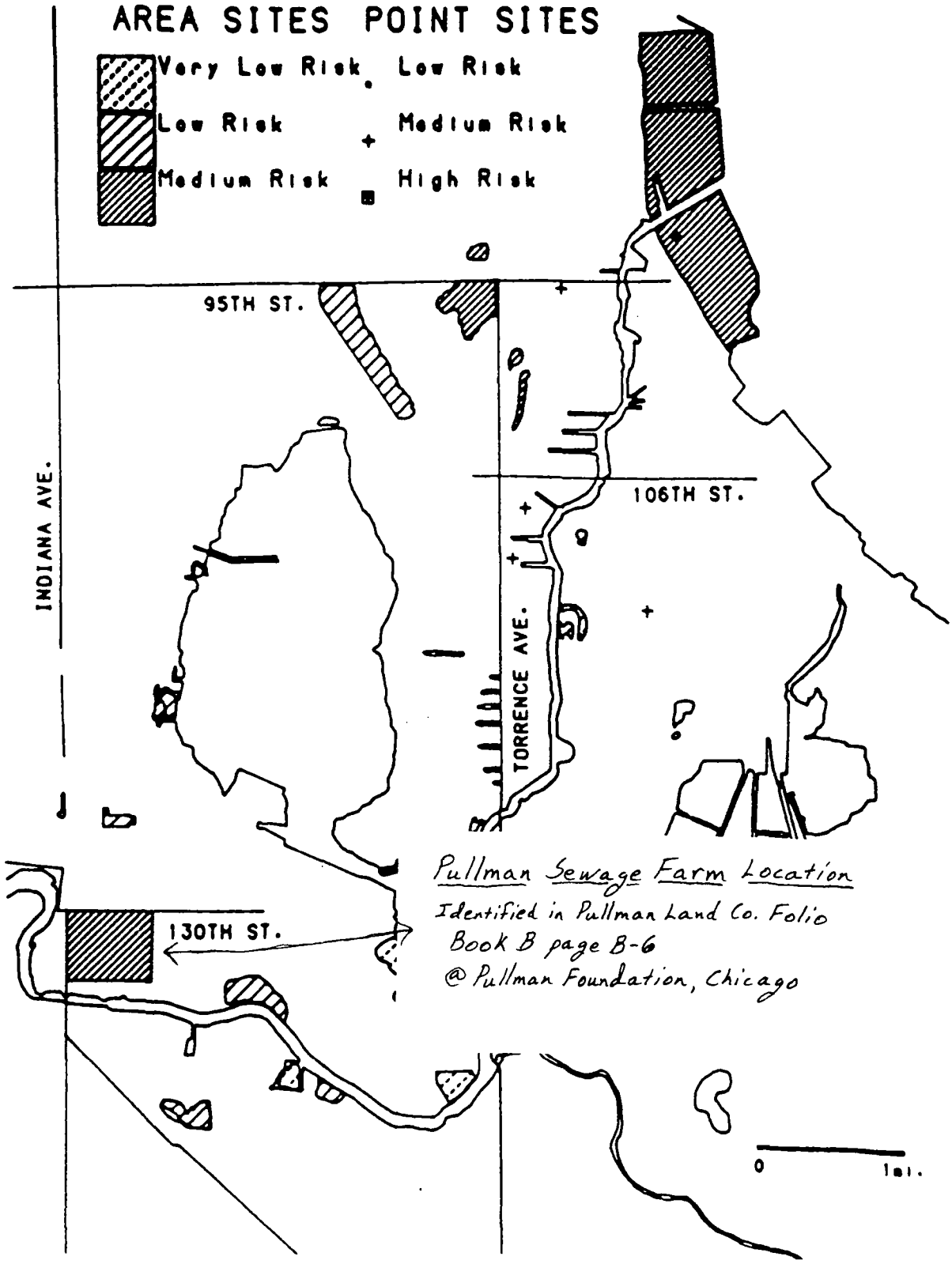
Land disposal was a viable method for industries to enlarge or improve their property in the marhsy environs of the Calumet region. A major study of the iron and steel industry concluded:

distillery, two pneumatic malt plants, and three grain elevators were found in the area in 1897 (Fig. 2-4). The total number of grain-using companies was up to eight by 1913. Since most grain arrived by rail, the waterborne commerce figures are of little value for estimating quantities. Grain elevators along the Calumet River had a capacity for over six million bushels, and local manufacturers probably used a large portion of this. No direct account of their waste disposal methods survives, but the general practice is known. Distillery slop was generally fed to cattle, which were sold at the close of the distilling season. According to a contemporary authority, this "results in a more dangerous pollution than would arise from the direct discharge of slops into the river."(73) European researchers were experimenting with the use of brewery wastes as fertilizer during the twenties, but this was not a widespread technique before 1920.(74) If grain wastes were not used as feed or fertilizer, they probably found their way to municipal dumps or waterways. One dump receiving organic waste from South Chicago existed at 93rd and Torrence, although commercial use was outlawed in 1887.(75) Distilleries and breweries also may have used a commercial scavenger who had an operation at the southern edge of the Eastside neighborhood, or they disposed of their waste on-site.

The third group of producers who contributed to waste production were the various chemical, paint, and oil manufacturers. Throughout the first period, a chemical firm making pickling liquors for steel mills operated in the bend of the Calumet River. The Sanborn maps show vats for muriatic, sulphuric, and nitric acid within the walls of this plant. South of Pullman, the Calumet Paint Company, later Sherwin-Williams, worked with lead and various vegetable oils to produce paints, varnishes, and lacquers. Additional lines of products added between 1903 and 1920 included arsenic-based insecticides, white lead, beta napthal, para nitraniline, toluidine, acetic acid, and lithopone.(76) The only measure of production was a reported 1,250,000 gallons of paint produced in 1911.(77) Liquid wastes from Sherwin-Williams presumably were handled by the Pullman sewage system, and solids probably were disposed on-site. Before 1900 the Cleveland Linseed Oil Company operated on the west bank of the Calumet River, and Jenkins and Company stored and barreled oil near the river and 95th Street. Just beyond the study area was the Hammond Glue Company, which the Army Engineers accused of contributing to the pollution of the Grand Calumet.

Another waste product produced by most operations in the area was fly ash. Coal was the primary fuel for manufacturing power and the skies of the Calumet were heavily laden with particulate matter. One outspoken editorial writer argued that smoke was a barometer of foolishness and not of prosperity.(78) An anti-smoke drive during the first few years of the twentieth century culminated in legislation aimed at controlling emissions, but it regulated only railroads. The drive to reduce atmospheric pollution promoted the expansion of electric rail lines, but the large electric generators continued to burn coal, as did the manufacturers. Their waste ash frequently was mixed with other refuse in landfills and could contribute to ground-water contamination. Silica and acidic leachates are associated with fly-ash.

The impact of industrial pollution was highly visible in the Calumet Region during the first decade of the twentieth century, as witnessed by the anti-smoke campaign and the Sanitary District's discussion on methods to



PRE-1940 WASTE DISPOSAL SITES

Figure 3-2: Disposal sites used prior to 1940. Risk designators refer to health hazards presently posed by former disposal sites. The ranking system considers length of existence, type of material discarded, soil permeability, and distance to residential areas. See Appendix for explanation of shading.
Source: Compiled from miscellaneous maps, reports, and aerial photographs.

GEORGE M. PULLMAN.

THE TOWN OF PULLMAN.

ILLUSTRATED.

Its Growth with Brief Accounts of Its Industries.

BY

MRS. DUANE DOTY.

T. P. STRUHSACKER,
PUBLISHER,
PULLMAN, ILL.
1893.

Preface.

This volume, made up almost entirely of descriptive sketches of many features of interest in Pullman, is prepared in response to frequent requests on the part of visitors here for such information. The writer has drawn freely from every accessible source of information, but has depended chiefly upon personal knowledge acquired by a residence here since the town was founded, and also upon a large variety of papers by her husband. Called upon, as she has been, to aid in the preparation of these papers she feels at liberty to use such portions of them as she needs. In addition it has seemed best to give in an appendix extracts from valuable documentary matter, such as the pamphlet by the State Bureaus of Labor Statistics, on the industrial, social and economic conditions of Pullman, made in 1884; the address by Rev. David Swing, at the Arcade theatre on the evening of April 11th, 1883; the address of Hon. Stewart L. Woodford, at the theatre Jan. 9th, 1883, and remarks of Mr. Charles Dudley Warner, in *Harper's Magazine* for June, 1888, and also the remarks of President George M. Pullman, supplementing his annual report for the year ending July 31st, 1892. The aim is to present little of anything, outside of the appendix, except descriptive matter which will convey to the reader an idea of the industries here. Our space

coat of red lead and then bronzed, if required, which protects the silver from oxidation.

BEVELING GLASS.

This is a process requiring several operations. The first grinding is upon a horizontal iron wheel upon which fine sand is sprinkled; then the beveled edge is still further ground upon a similar wheel covered with emery. The next step is grinding upon a horizontal grindstone, which is only found in Scotland; then vertical wooden wheels put a more finished touch upon the beveled edges and finally the cut edge is perfectly polished upon vertical felt wheels covered with rouge. The grinding of glass is regarded as better than the acid treatment where silver is to be used upon the translucent portion. The silver used is purchased in the form of crystals of the nitrate, which are dissolved to obtain the liquid used as above described. There are certain features about this chemical work which are peculiar to this department and differ from those used elsewhere. The work done here is unsurpassed in excellence. What is known as cut-beveling is now done in the highest style of the art.

GLASS IN A CAR.

We have seen over 600 square feet of glass in a Pullman coach. Of this glass 116 square feet were in mirrors and over 100 feet of it had been embossed. Excellent plate glass is made in this country by such establishments as the Pittsburg Plate Glass Company, the DePaw Plate Glass Company, at New Albany, Indiana, and by the Crystal City Plate Glass Company, of Missouri.

The very best kinds of plate glass are now made by the London and Manchester Plate Glass Company, England, and at Manheim, Bavaria, and in France and Belgium. Glass making was one of the earliest industries undertaken in this country, the first glass works being established at Jamestown some years before the landing of the Pilgrims. Capt. John Smith, in 1615, wrote that he felt that the efforts at glass making at Jamestown were somewhat misdirected, and this was five years before the Pilgrims reached Plymouth. At ordinary temperature glass is practically indestructible. All efforts at making malleable glass have so far failed. Recent experiments would seem to indicate that nearly all the gems can now be so closely imitated in glass that none but experts can detect the imitations. The brightest colors of flowers and rainbows are now almost pefectly reproduced by Bohemian and Venetian glass workers.

GARBAGE.

Garbage at Pullman is collected daily from receptacles provided for it at the rear of lots, and is taken to vacant land, distant from the town, and buried. The question of disposing of this waste by some of the processes for rendering it or destroying it by fire is under consideration. The time is approaching when all that has any commercial value will be extracted from this class of waste and the refuse used as fuel. Most waste of this sort has fuel enough in it to do the work of rendering it. The best mode of disposing of garbage in cities is not yet a settled question. Recent authority favors burning garbage, and this method is coming into use.

who apply the roof-boards, moldings, etc., and then the tinners put on the metal covering. After a careful inspection the car is taken by the outside painters, and is entered at the same time by the inside finishers, who put in and finish the nice inside woodwork—which is of the best kinds of lumber, such as oak, ash, cherry, mahogany or vermillon. The piping for heating and for lighting is set in before the seats are placed in position. The inside finish, too, conceals the electric wires which may be called for in the specifications. Cars are lighted by oil, gas or electricity. If by gas, it is carried in condensed form in tanks underneath the car and is conducted to lamps by suitable piping. Electric lights are derived from storage batteries and from dynamos run in a baggage car, by steam from the engine.

When the inside woodwork is all in place—and some of this finish comprises exquisite carving—the inside painters go over the entire interior wood work, making the car ready for the trimmers, who place the bronze or plated trimmings upon doors, sash-blinds and walls. The upholstering, draperies, seat-coverings, carpets, etc., which have all been previously prepared, are now put in, and when the finishing touches are added by the equipment department the car is ready for delivery to its purchaser, to whom it is sometimes sent by special messenger. Parties for whom cars are built generally keep an inspector at the shops to see that all work and materials are in accordance with plans and specifications. All work in the construction department is carefully sub-divided, many different gangs of men having their allotted tasks, which they perform with surprising quickness

and dexterity. Most of this passenger-car work is paid for by piece wages. These car works have the capacity for turning out twelve new passenger cars a week.

PULLMAN FARM.

One hundred and forty acres of land have been thoroughly piped and underdrained for the reception and purification of sewage with which these acres are irrigated. Hydrants are placed at suitable intervals so that the distribution can be conveniently effected. All organic matter in the sewage is taken up by the soil and the growing vegetation, and the water, making from 200 to 600 parts of the sewage, runs off through underdrains to ditches which carry these filtered waters into Lake Calumet. Where the sewage water, purified by filtering through the soil, leaves the drains, it is as clear and sparkling as spring water, and purer than the water from the surface wells used by people on neighboring farms. In winter the sewage runs upon one field or upon one filter bed and then upon another, the filtering processes appearing as perfect as in summer. Thus are waste products utilized, being largely transmuted by vital chemistry into luxuriant vegetable forms. The most profitable crops for this farm have been found to be onions, cabbage and celery. In Europe the question is, at how little expense can such a farm be operated, the primary object being the necessary disposal of the sewage, and the proceeds from crops raised merely diminishing operating expenses. A European sewage farm operated at a profit is the exception and not the rule.

work, as is seen in the fact that their average earnings here are larger than in any other place where similar work is done, but to do it comfortably in these finely arranged and equipped shops and factories. While they are at work their children are in the best of schools, and their families are sheltered in superior homes. As a social and business experiment the place attracts the attention of the philosophers, political economists, students of social science, and the capitalists in every civilized country.

STEAM HEATING OF TOWN AND SHOPS.

All departments of all the car shops in Pullman are heated by steam. It is necessary to maintain an even temperature wherever painting and varnishing are in progress, and the workmen, too, are thereby able to attend to their duties in comfort. All the monumental buildings in the town—such as the Arcade, Hotel, Market, Green Stone Church and the Casino are also heated by steam from boilers at the car shops. Connected with every furnace in the hammer shop, in which axles and wrought iron are heated, there is a tubular boiler. The fire, after heating the iron, passes under these boilers and in this way the heat performs two duties instead of one. The engines and hammers of the hammer shops are operated from these boilers and the surplus steam is conducted through a six-inch pipe to the eight-inch main, which feeds the heating pipes in the shops and town. A regulating valve retains a pressure of seventy-five pounds on the hammer shop side in order to operate the engines and hammers there; and from fifty to sixty pounds is kept on the Corliss engines

side of the regulating valve, so the surplus steam over seventy-five pounds has simply to force itself against a maximum pressure of sixty pounds in a connected pipe, and thus the steam not needed for work is utilized for heating purposes—and steam so used costs little if anything, for, if not used in heating, it would simply be wasted. The dwellings on 111th street, and those in Arcade row and in the west half of block No. 2, also have steam heat. Those who reside in houses heated by steam pay a fixed price monthly for the heat, as they pay for water and gas.

Sewerage.

The great value of the work done here is principally suggestive, and is studied by travelers and scientific men of every continent.

At the outset it was decided that it would never do to permit the sewerage to flow into Lake Calumet, as it would make a cesspool of that body of water, and to obviate such a result the mode of disposing of the Pullman sewage here outlined was decided upon.

DEEP SEWERS.

The surface piping provides only for atmospheric water, and sewage does not enter it. An entirely separate system of pipes carries sewage from dwellings and shops. These sewers are laid deep enough to pass under all the surface drains, and sewage in them from houses goes by gravity to a cistern or reservoir under the water tower, entering the cistern sixteen feet below the surface of the ground. The capacity of this reservoir is 300,000 gallons. The

sewage is pumped, as fast as received, through a twenty-inch iron main to a sewage farm three miles distant. At the farm end of this pipe the sewage goes into a receiving tank made of boiler iron, which is set a few feet above the surface of the ground. Through the center of this tank there is a screen in an oblique position, through the meshes of which substances more than half an inch in diameter cannot pass and get into the piping in the farm. The sewage waters pass through this screen and thence into the distributing pipes, a pressure of not more than ten pounds being allowed upon those pipes. The sewage is sent from the reservoir so rapidly that there is not sufficient time for any fermentation to take place, and there are no perceptible odors from it at the pumping station. The piping used for block drainage is only six inches in diameter, the smallness of the pipe insuring a scour, which keeps it clean and practically self-flushing. The deep sewer mains are only 12, 15 and 18 inches in diameter. The amount of this vitrified piping used for the deep sewers to date (October 22, 1892) is as follows:

	Feet.
Of 18-inch pipe	4,340
Of 15-inch pipe	3,170
Of 12-inch pipe	1,220
Of 9-inch pipe	7,210
Of 6-inch pipe	32,250
Of 4-inch pipe	31,350
Total	79,540

These two systems of pipes constitute what engineers term the separate plan of drainage and sewerage. In all the drains, sewers and laterals here there

are 440 manholes, and they are set from 140 to 165 feet apart. The manhole covers of surface drains are solid, but the covers for the manholes of deep sewers are perforated. The amount of sewage pumped yearly from the reservoir to the sewage farm is shown in the following table:

	Gallons.
1882	211,620,160
1883	358,354,400
1884	443,815,480
1885	468,302,120
1886	472,748,080
1887	573,700,640
1888	588,607,760
1889	602,250,000
1890	657,001,360
1891	617,664,000
1892	698,122,780

SEWAGE FARM PIPING.

The tract known as the Pullman Sewage Farm embraces 140 acres, piped and underdrained for the reception and purification of sewage. An acre of land can be tilled and at the same time take care of the sewage made by one hundred persons. Some of the sewage farm lands near the city of Berlin take much more than this amount of sewage. All this land can be irrigated, and it is all underdrained. Vitrified pipe from six inches to a foot in diameter conduct the sewage through the fields. This piping, laid from five to six feet deep, and hydrants at convenient intervals of three or four hundred feet, admit of running the sewage over the surface of the land. The land through which the sewage filters takes up nearly all the impurities, the filtered waters coming out sparkling and clear from the underdrains. The underdrains in the farm are of three and four-inch

farm tile laid in rows fifty feet apart. There are also fifteen small tracts of about an acre each called filter beds, which are surrounded by dirt walls, and these beds are underdrained with lines of farm tile only a few feet apart, and, if necessary, one of these beds can take all the sewage pumped for a day, the whole mass disappearing and filtering through the soil and running out of the underdrains in a few hours. One of these beds can be used every fifteen days, if needed, as in winter time.

IRRIGATION.

The use of sewage for growing crops depends upon the season. In dry seasons it is freely used with the vegetation needing it most. Irrigation is practiced at all seasons, and the waters filter through the soil as well in the winter as during the summer. The crops which have so far proved most successful are onions, potatoes, cabbages, celery, beets, parsnips, carrots, sweet corn and squashes. Potatoes are the least successful crop; celery, asparagus, and cauliflower coming next in order as not growing so well on this farm. Properly cultivated, twice as much can be raised on land irrigated with sewage as upon adjacent land unirrigated, and with onions the results are still better. We have never had any trouble with deposits of sludge. Nature seems to have provided for the disposal of sewage by surface deposit, but just how it is cared for and rendered innocuous is not yet entirely clear to chemists. Much of the organic impurity of sewage is taken up by growing vegetation, and some authorities have intimated that portions of such impurities actually go into mineral forms. One thing

is certain, the result of surface irrigation of land is almost a complete purification of the sewage, and that is the chief object of a sewage farm. Within half a century not a state in the Union will permit any sewage to enter lakes or running streams. Had legislative bodies a knowledge of the dangers attendant upon polluting waters with sewage, the custom would be stopped at once. There is today no more important municipal problem than the proper disposal of sewage.

ANALYSIS OF PULLMAN SEWAGE.

The only analysis of Pullman sewage in the writer's possession was made in the office of the Massachusetts Board of Health Nov. 30, 1887. Four samples were forwarded, and the results were returned here as follows: (Omission, of course, is made of any muddy sentiment which was held in suspense in the liquids. The numbers and decimals below represent parts in 100,000.)

	AMMONIA.		Chlorine.	Nitrogen.
	Free.	Albuminoid		
Pure sewage	2.3000	.3200	1.98	None.
Filtered sewage from manhole on filter bed	.8500	.0480	2.31	1.560
Filtered sewage from mouth of main underdrain	.0428	.0108	3.78	.650
Water from farm well	.0500	.0166	1.78	.033

It will be seen from the above that the filtered sewage waters issuing from the mouth of the main under drain were much purer than the water in the farm well, and far more wholesome for drinking than the well waters in that neighborhood. It is not an uncommon thing for laborers on European sewage

farms to drink the filtered waters which flow from the underdrains.

COST OF OPERATING THE PUMPS.

The cost of operating one of these pumps for twenty hours and pumping 1,800,000 gallons of sewage is as follows:

Cost of coal used	$1.73
Cost of oil and waste	.57
Engineer's wages	3.75
Total	$6.05

This is a trifle less than 33 cents for pumping 100,000 gallons.

STABLES.

The large stables stand just south of the Arcade, and have stalls for sixty horses. Men who own horses here keep them at these stables, as no barns have yet been built. The front of the building contains the Pullman fire department, the second story being used for sleeping apartments. The Central Telephone station is also here. The stables have a good supply of horses and carriages, and do a large livery business.

Street Car Building.

ORDERING CARS.

With few exceptions, officers of street railway companies do not furnish drawings and specifications for the cars they may desire. The custom is merely to state the length, width and height of cars and the style of trucks to be used, The chief designer of the shops where the cars are to be built, after a full conference with the parties desiring to purchase, makes drawings in detail and full specifications. Car shops are usually provided with drawings, cuts and photographs of all the styles of cars they have built, and purchasers can easily decide from such drawings just what style of car to order. Several styles are always in process of construction and can be examined by those desiring to purchase. After plans and specifications have been approved and accepted and the contract let, the manager of the shops receives written instructions for every detail of the work. Street cars are made here for nearly every state in the union, and in greater variety than in any other car shops in the world. The Pullman Street Car Works employ about four hundred operatives.

DETAIL DRAWINGS.

These drawings show, first, an elevation of a finished car, then, in detail, the sills and floor framing and all matters relating to the floor. The drawings of the side framing show the side posts, side bracing and side panels. Another set of drawings exhibits the details of the deck, including everything above the side frame, such as carlines, deck posts, deck sills, deck plates, and side plates, beginning at the top of the posts. There are also drawings showing the ceiling finish, or head lining. The cars which have carline finish have no decoration. There are full detail drawings of hoods, platforms and even of the bronze trimmings, however small. Some of these details rank as *standard* and go into all kinds of street cars built at these shops.

The Water Tower.

The tower has, from prehistoric time, been a prominent structure with all races. Even the Tower of Babel of scriptural fame seems to represent a class of structures rather than an individual one. There is no good reason to suppose that the unburned brick Tower of Babel reached any very considerable height even after Nebuchadnezzar had ostensibly finished it. Ruins in Central America and traditions among the natives point to towers like that of Babel which experienced like drawbacks in the way of confusion of tongues. There are exactly similar traditions in northern India of a primeval tower which had the fate of that of Babel. Livingstone, when first at Lake Ngami, found the same tradition among the native Africans. The natives of Australia have a number of legends relating to a tower which early man undertook to build to the skies, but which the gods stopped by confounding the language of the builders. Ossa on Pelion may be regarded as another version of the tower story, so that Babel seems to have prevailed throughout the world among widely separated and distinct races of men. The towers of Ireland are too well known to need more than a bare mention. The leaning tower of Pisa, which is 179 feet high and 50 feet in diameter, stands 13 feet out of perpendicular, has walls 13 feet thick at the base, and has stood for many centuries. The original towers were an outcome for war or religious purposes, while those of today are utilitarian in character.

This massive structure, sixty-eight feet square at

the base and resting upon a very heavy cut-stone foundation, rises to the height of 195 feet to the base of the flag-staff; it is 210 feet to the top of the flag-staff. The dimension stones of the lowest courses in the foundation are nearly 40 feet below the surface of the ground, resting upon a blue clay so hard and tough that blasting was necessary in making a portion of the excavation for the building. This great depth was necessary in order to secure the large underground cistern, into which the sewage of the city flows. The city sewage mains enter this cistern sixteen feet below the surface of the ground, and it has a capacity of 300,000 gallons. The cistern is covered with a floor of solid masonry, resting upon piers and brick arches, and upon this floor, ten feet below the surface, sewage and water pumps are placed

THE PUMPS.

There are three Blake steam pumps, with capacity for pumping 60,000 gallons per hour. These pumps are connected so as to pump either Lake Michigan or Calumet water. Their ordinary work is to supply Calumet water for the elevators and for shop use. But when it becomes necessary to refill the tank the connection with Lake Calumet is closed and Lake Michigan water alone is pumped into the tank.

There are two Cope & Maxwell compound condensing pumps for sending the sewage to the farm. They have a capacity of five million gallons a day, though they have only a third of that work to do.

THE WATER TANK.

The tower is square for about two thirds of its height and octagonal for the upper third. In the top

of this tower a boiler-iron tank, 55 feet and 10 inches across and 30 feet and 1 inch deep was built, in which half a million gallons of water are kept. The exact capacity of this huge tank is 550,995 gallons or 2,086,000 liters. The weight of this body of water is as great as that of 76 thirty-ton locomotives; in all 2,297 tons. The weight is nearly one ton for every square foot of the bottom of the iron reservoir. This is the largest tank in the world placed at so great an elevation. The object of this tank is to give a great pressure of from 70 to 75 pounds to the inch upon the mains. For fire purposes all that is necessary is to couple hose to the most convenient hydrants and the pressure easily carries water over any other building in the city. The tower pressure is only used in case of fire, the ordinary water pressure from the Hyde Park pumps being sufficient to keep a good supply of water in all houses. This reservoir is always kept nearly full and can be rapidly replenished if in use. It is supported by a net work of iron trusses resting upon four long and heavy wrought iron columns which extend to the basement where they rest upon massive piers which start from the blue clay 30 feet below. These four wrought iron columns might be considered the legs of a table upon which the reservoir is placed. The peculiar construction of this water tank and the pipes and valves which are used in supplying and distributing the water are of little interest except to the professional engineer. The several stories between the ground and the bottom of the reservoir are now chiefly used for storage, and light manufacturing, elevators connecting the successive floors.

THE SEWAGE RESERVOIR.

The sewage of the town runs by gravity from houses to the cistern under the tower and is pumped away through a twenty-inch iron main to a sewage farm three miles distant and south of the town. It is pumped as fast as received, so that no fermentation can take place and no noxious odors rise from it. The cistern is ventilated by eight flues which run to the top of the tower and by a twenty-inch flue which connects the air over the sewage with the large chimney of the boiler house; this air is carried away with so much force as to create a strong downward draught through the man-holes in the floor over the cistern. There is nothing offensive at this pumping station and there are no odors that can be detected beyond those of the oil used about the pumps and machinery. The stories of this structure below the water tank are admirably adapted for some light manufacturing, such as jewelry and watch making, as the rooms are well lighted on all sides.

WORK DONE IN THE TOWER.

For the present the second floor of the Tower is occupied by the electrical department of the car shops. Here are made electrical annunciators for cars, push buttons, batteries and material for lighting trains. Here may be seen the Edison dynamo which lights the repair shops with 800 incandescent lights; two Ball dynamos which light the paint department of the freight car shops, using sixty-six arch lights; there are also an Eickmeier dynamo used for charging batteries and lighting rooms in the tower. There are now twenty-six operatives employed in this electrical work. Here glass beveling, etching, crystalizing and embossing are all done and fifty operatives are engaged in this industry. The fifth floor is occupied by a branch of the paint department. The remaing stories are used for storage.

Bolts and Bolt Department.

Few except those in charge of such work have any adequate conception of the thousand and one different things which enter into the construction of a car, either of the freight or passenger type. It may surprise some readers to learn that from 600 to 1,000 bolts are used in building a single freight car, and that for a first-class passenger coach about 1,000 are needed in addition to the 800 required in two good six-wheel trucks. A careful inspection of a car will reveal the heads of these bolts and the nuts which hold them in place. To make the bolts used in large car works like ours requires half an acre of floor space studded with machinery, needing seventy-five horse power for operation and the services of eighty workmen, who are able to transform sixty tons of rod-iron per day into 50,000 bolts of all kinds, 90 per cent of the work being of the piece class.

KINDS OF BOLTS.

Not less than fifty different forms of bolts are manufactured, and there are many sizes of some of these forms, and if these sizes are taken into consideration the number of kinds of bolts easily runs into the hundreds. Round iron, varying from one-fourth to two and one-fourth inches in diameter, is

at Guise, France; the humanity of Sir Titus Salt, that brought into existence the industrial town of Saltaire, in Yorkshire, England; and the broad Christian inspiration which resulted in the founding of Pullman have given the world, in the four greatest manufacturing countries, four magnificent schemes for the uplifting of a large portion of the people seeking a living through wages.

In all the countries named there have been many other experiments worth a careful study of all interested in social advancement. This is thoroughly true of our own country, and we might call attention with justice to the success at Peace Dale, R. I., at St. Johnsbury, Vt., at Willimantic, and Manchester, Conn., and at other points. But, for comprehensive plan, for careful recognition of all the strong points, and the fullest anticipation of all weak features, for the beauty of the executed plan, for the financial and social success thereof, Pullman City as the outgrowth of the newest of the great manufacturing nations stands at the head.

Four or five years ago Mr. Pullman determined to bring the greater portion of the works of the company into one locality. To accomplish this he must leave the great cities for many reasons, and yet it was essential that a site should be selected where communication could be had with the whole country, and near some metropolitan place like Chicago. He wished above all things to remove his workmen from the close quarters of a great city, and give them the healthful benefits of good air, good drainage, and good water, and where they would be free, so far as it would lie in the power of management to keep them free, from the many seductive influences of a great city.

He was fortunate in securing about 4,000 acres of land on the Illinois Central Railroad, a dozen miles to the south of Chicago.

THE SITE.

The city is situated upon the west shore of Lake Calumet, which is a shallow body of water three and a half miles long by a mile and a half in width. This lake drains into Lake Michigan through the Calumet river, Lake Michigan being not more than three miles distant. The site of that

portion of the city now fully covered with buildings, is from eight to fourteen feet above the level of Lake Calumet. The soil is a drift deposit of tough blue clay, ninety feet in depth, resting upon lime rock. The land gradually rises to the north and west to an elevation of twenty-five feet above Lake Calumet, this being usually from three to five inches higher than Lake Michigan. There is no land of a marshy character in this neighborhood. The bottom of Lake Calumet is of hard blue clay, from which the best cream-colored brick are made. It was deemed unwise to permit any sewage to flow into Lake Calumet, so the system of drainage adopted is what is known as the *separate* one.

On the 25th day of May, 1880, ground was first broken for the building of the Palace Car Works, and the City of Pullman. The land was an open and not over-promising prairie.

The first efforts were directed toward the scientific drainage of the future town. In old cities drainage follows construction, for the average village or city is but the haphazard conglomeration of odds and ends in the way of buildings, whose inartistic forms, defective construction, and inconvenient arrangements are supplemented by such drainage and sewerage systems as can be utilized. It is rare of course in the nature of things that drainage is thought of at the outset. It comes after a lapse of time, when the soil has become charged with the accumulated filth of years, and all attempts at sewerage are then more or less unsatisfactory.

The City of Pullman, on the other hand, has been built scientifically in every part, and is exceptional in respect to drainage and sewerage if in no other regard. For here the drainage preceded the population, and the soil is now as free from organic contamination as when it formed a portion of the open prairie. Every house has been constructed from approved plans, and under the supervision of competent builders and engineers.

The perfection of the site selected was accomplished through surface drainage, and the construction of deep sewers. (All described in the foregoing pages under proper heads.)

The appearance from the railroad as one approaches

and incapacity. Before anything else was done on the flat prairie, perfect drainage, sewerage and water supply were provided. The shops, the houses, the public buildings, the parks, the streets, the recreation grounds, then followed in intelligent creation. Its public buildings are fine, and the grouping of them about the open flower planted places is very effective. It is a handsome city, with the single drawback of monotony in the well built houses. Pullman is within the limits of the Village of Hyde Park, it is not included in the annexation of the latter to Chicago.

[Since Mr. Warner wrote this, Hyde Park, inclusive of the territory upon which Pullman is situated, has been annexed to the city of Chicago. Pullman is now in the Thirty-fourth Ward of Chicago.]

It is certainly a pleasing industrial city. The work shops are spacious, light and well ventilated, perfectly systematized; for instance, timber goes into one end of the long car shops, and without turning back, comes out a freight car at the other, the capacity of the shop being one freight car every fifteen minutes of the working hours. There are a variety of industries, which employ about 4,500 workmen.

[The number of wage-earners in all the departments of business and industry here October 1, 1892, was 6,324, and 300 of them were women and girls.]

Of these about 1,500 live outside the city. [2,000 October 1st, 1892.] The company keeps in order the streets, parks, lawns and shade trees, but nothing else except the schools, is free. The schools are excellent, and there are over 1,300 children enrolled in them. The company has a well selected library of over 6,000 volumes [8,000 October 1st, 1892], containing many scientific and art books, which is open to all residents on payment of an annual subscription of $3. Its use increases yearly, and study classes are formed in connection with it. The company rents shops to dealers, but it carries on none of its own.

Wages are paid to employes without deduction, except as to rent, and the women appreciate a home beyond peradventure. The competition among dealers brings prices

to the Chicago rates, or lower, and the great city is easily accessible for shopping. House rent is a little higher for ordinary workmen than in Chicago, but not higher in proportion to accommodations, and living is secured a little cheaper. The reports show that the earnings of operatives exceed those of other working communities, averaging per capita (exclusive of the higher pay of the general management) $590 a year. (The average for the year 1887 was $601 per capita.) I noticed that piece wages were generally paid and always when possible. (Three-fourths of the operatives are paid by piece wages, October, 1892.) The town is a hive of busy workers; employment is furnished to all classes, except the school children, and the fine moral and physical appearance of the young women in the upholstery and other work rooms would please a philanthropist.

Both the health and "morale" of the town are exceptional, and the moral tone of the workmen has constantly improved under the agreeable surroundings.

Those who prefer the kind of independence that gives them filthy homes and demoralizing associations seem to like to live elsewhere. Pullman has a population of 10,000 (it was 11,702 Aug. 1, 1892), nearly as many more residing within a mile or so of its railway station. I do not know another city of 10,000 that has not a place where liquor is sold, nor a house nor a professional woman of ill repute. With the restrictions as to decent living, the community is free in its political action, its church and other societies, and in all healthful social activity. It has several ministers; it seems to require the services of only one or two policemen; it supports four doctors and one lawyer.

[The entire country has one doctor for every 500 persons.—ED.]

I know that any control, any interference with individual responsibility is un-American. Our theory is that every person knows what is best for himself.

It may not be true but it may be safer in working out all the social problems than any lessening of responsibility either in the home or in civil affairs.

When I contrast the dirty tenements, with contiguou-

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STATE GEOLOGICAL SURVEY DIVISION

JOHN C. FRYE, CHIEF
121 NATURAL RESOURCES BUILDING
UNIVERSITY OF ILLINOIS CAMPUS
URBANA

May 17, 1955

GEOLOGIC REPORT ON SHALLOW GROUNDWATER POSSIBILITIES FOR PRIVATE SUPPLY AT LANSING, COOK COUNTY, NEAR THE CENTER OF THE E. ½ OF SECTION 31, T. 36 N., R. 15 E.

By

John W. Foster, Assistant Geologist
Division of Groundwater Geology and Geophysical Exploration

(prepared in response to the inquiry of Mr. Walter Urbanski, 18050 Ridgewood Avenue, Lansing, Illinois)

This property is situated on one of the beach ridges of Ancient Lake Chicago. Much of the surface material in this immediate area is sandy, and the crest of the low beach ridge is marked with occasional low sand dunes, particularly west of Lansing. This beach deposit is underlain by tight clay and silt. The top of the solid dolomite bedrock is probably below a depth of about 100 to 125 feet.

Our records indicate that there has been very little development of groundwater contained in the sands of the beach ridges of this part of Cook County, probably because at most locations the sand deposit is too thin to permit adequate well construction. It is quite likely that the depth to the tight silt and clay below the sand is less than 25 feet, possibly less than 15 feet. An extended soil auger of 1 to 4 inches in diameter might be adequate to determine the possible thickness of the sand deposit at this location and to determine its suitability for a drive point well.

Most drilled wells in the area penetrate the entire thickness of the unconsolidated material over dolomite rock and tap groundwater from open cracks in the solid Niagaran dolomite at depths of 100 to 150 feet. Records indicate that there is some possibility of locating water-bearing sands within the glacial drift material above the rock, but these are not likely to occur in the upper 40 feet of material and they are probably not available for drive point wells because of the tight material which lies above them.